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ABSTRACT

Several of the problems typically associated with efforts to extend higher education opportunities to rural communities--including small class size, lack of qualified instructors, and maintenance of quality standards--are successfully addressed by an audio conference network. Students in remote locations can participate in classes offered through regional centers where class size requirements are already met and trained instructors are available. The addition of computer graphics capabilities to such a network increases the potential for classroom interaction and reduces problems associated with delivery of visual aids and other learning materials to distance learning sites. The Voice-Too modem incorporated in the Optel Telewriter II-PC system transmits voice and data simultaneously on one standard, dial-up telephone line, thus preserving the cost effectiveness of the audio conference method, a key to realizing the goal of providing equal opportunity in education to rural America. The Optel interactive computer graphics system was selected to enhance successful audio conference courses offered in northeastern Washington. The Optel system is relatively inexpensive (particularly as compared with interactive television), requires little training to operate, and is portable. The potential exists for a wide spectrum of uses by many sectors of rural communities.
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Interactive Computer Graphics Enhancements to a Rural Academic Audio
Conference Network

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INTERACTIVE COMPUTER GRAPHICS ENHANCEMENTS TO A RURAL ACADEMIC AUDIO CONFERENCE NETWORK

The Community Colleges of Spokane Institute for Extended Learning provides educational programs through extension centers in a 12,302 square mile area encompassing Ferry, Pend Oreille, Spokane, Stevens, Whitman, and a portion of Lincoln counties in Washington State. Despite linkages with thirty school districts, three Indian reservations, four centers for training the disadvantaged, an Air Force Base, and various industrial sites, several geographic areas, because of their remoteness and small population, were underserved.¹

In the spring of 1984, Community Colleges of Spokane moved to address the needs in one of these areas by developing a Rural Instructional Continuing Education (RICE) module in Republic, Washington. Republic is located in Ferry County, a county with a total 1984 population of 6,100, many of whom reside on the Colville Indian Reservation in the southern half of the county; the county is bordered by the Columbia River on the east, the Okanogan region on the west, and Canada to the North.

Educational services provided in this RICE module include ABE/High School Completion/GED Preparation, community service classes, academic and vocational transfer courses, and counseling services for financial aid, veterans, student assessment, and career planning. While a few academic and vocational courses are delivered in the traditional manner (instructor in a classroom setting), most academic coursework is delivered via an audio conference network emanating from the Colville Center located 70 miles east of Republic in Stevens County.

The record of program success and high student satisfaction in Republic generated requests for audio conference academic coursework from other parts of northeastern Washington. This demand, coupled with the District's commitment to serve areas with limited access to education, resulted in plans to expand and enhance the audio conference system. Two additional sites in Ferry County, Curlew and Inchelium, were added to the audio conference network during the 1985-86 school year; expansion to other locations in Stevens and Pend Oreille counties is currently under review.

Current technologies were explored to determine the most economical way to enhance the existing network. One system, the Optel Telewriter II-PC™ Conferencing System, was identified which would provide high quality visual representations, access to a television quality "freeze frame" picture library, electronic "blackboard" or "notepad" capability, and computer interaction simultaneous with voice without having to use multiple telephone lines, cable microwave, or satellite. Initial installations of this hardware are scheduled for September, 1986 and will be at least partially operational for Autumn Quarter. Instructor training materials are also under development, and staff training and library development will take place prior to the initialization of the new system.

The Audio Conference Network

The network was developed in response to identified needs for academic credit courses in geographically isolated areas of northeastern Washington. Traditional delivery methods were inappropriate in these areas due to low enrollment prospects and unavailability of qualified instructors. The solution had to be **low cost, relatively easy to implement, and flexible**. Audio teleconferencing met these goals, and has met or exceeded educational quality requirements as well.

Central to the audio system are voice grade (non-conditioned) dial-up phone lines. Because these can be secured for a relatively low monthly charge (\$35-250/mo depending on distances involved), the cost per hour is quite low when the line is used a significant number of hours per day.

If classes are mounted on a typical 8:00 a.m. to 3:00 p.m. and 7:00 to 10:00 p.m. schedule, for a total of 10 hours per day, the cost per hour makes delivery of coursework to a small number of students very economical. Assuming 22 days/mo X 10 hrs/day or 220 hrs/mo, the per hour costs vary as follows depending on the line charge:

$$\text{\$35/mo line} / 220 = .159 \text{ per hour}$$

$$\text{100/mo line} / 220 = .454 \text{ per hour}$$

$$\text{250/mo line} / 220 = 1.136 \text{ per hour}$$

At these hourly rates, even a very large network would cost substantially less to operate than a system based on the \$300-400 per hour charge for satellite video transmissions.

Equipment used in classrooms has varied from inexpensive conference telephone sets costing around \$200 to more elaborate systems available through AT&T for around \$1500. The larger the class the better the sound and microphone system requirement. More expensive systems are available (up to \$5000 per location), but the limitations of older telephone company mechanical switching equipment tend to limit the gain in quality one would normally receive from a more expensive system.

Initially, phone line bridging was not used, but as the network expanded to include three remote locations, it became apparent that bridging would be required in order for students in the remote sites to have dialogue with each other. A short range solution was achieved through the use of a small business switchboard system available through Northern Telecommunications for less than \$2000. Further expansion of the network will also require that the bridging system be expanded.

During the 1985-86 school year the following classes were successfully offered on the audio conference network:

Fall 1985	Introduction to Business 101
	American Civilization 121
	English Composition 101
	Introduction to Humanities 101
	Business Law 205
Winter 1986	General Psychology 101
	American Civilization 122
	Advanced English Composition 201
	Introduction to Speech 101
	Speech Composition 109
Spring 1986	Personnel Administration 231
	Introduction to Literature 131
	Introduction to Politics 101
	Ethics 210
	Introduction to Logic 201
	English Composition 101

Students and instructors readily adapted to the audio conference system. Students found that they had to take a higher level of responsibility for learning than if they were sitting in the same classroom as the instructor. They also had to develop good listening skills.

Instructors found that they needed to speak more clearly, be better organized, rely less on non-verbal communication, and prepare visual aids, tests and other written materials in advance so they could be shipped via UPS or bus service to the remote sites.

Despite general satisfaction with the audio conference system, instructors expressed a desire to enable remote students to see and interact with spontaneously written blackboard materials, pictorial and graphic references. Students, although generally grateful for the opportunity to receive higher education instruction in their own communities, desired more participation in classroom activities than the audio only system afforded. It was with these criteria in mind that research was undertaken which would lead to implementation of the interactive computer graphics system.

Computer Graphics Enhancements

With technologies changing so rapidly, it was virtually impossible to track down every piece of hardware and software package that sounded like it could be used in teleconferencing. A direct approach to the issue was taken by sending a representative to the International Teleconference Association (ITCA) Convention in Madison, Wisconsin, which was sponsored by the University of Wisconsin Center for Interactive Programming (CIP). Teleconferencing professionals from throughout the world came together to present and examine case studies in audio, graphic, freeze frame, computer and video teleconference systems. It became apparent that a combination of computer graphics and freeze frame technologies would meet the needs of the Northeast Washington model.

A presentation by Denis J. Martin, Project Coordinator, Board of Cooperative Educational Services in Norwich, New York, on "Audiographic Conferencing in Small Rural Schools in New York State" provided an interesting model for exploration. He described a pilot project begun in January, 1985, to link six school districts in upstate New York via the Optel Telewriter II-PCTM Conferencing System. The essence of this system, as described by Mr. Martin, is as follows:

"Central to the success of this system is its ease of set-up and operation. The call is started by the teacher 'who sets up the bridge.' Once all locations have been added to the bridge, the teacher instructs each location to put their system 'on-line' by pressing a button located on the modem. Once on-line, all participants have the ability to interact audibly and visually.

The system's specialized software provides users with numerous capabilities. The central feature, though, is the real time transmission of handwritten graphics or keyboarded alphanumerics. Operating on a 'common screen' basis, each location views the screen and has access to it via the graphics tablet. In this way the system functions very much like older electronic blackboards. Key, though, is the common screen basis. This means any participant can pick up his/her pen and 'write something on the blackboard in front of the class,' without having to do any complicated keystroking to transfer control of the system. Other features of the system include the capability to write in two colors, an on-screen pointer, and selective or total erase. The software also allows for operation in both 40 (medium resolution) and 80 column (high resolution) display modes with 16 background colors and two palettes.

In addition to these real time features, the Optel system also makes use of the storage and applications capacities of the microcomputer in which it is based. The Optel software gives the user the ability to create 'pages' (screens of information) and then write them to disk for later retrieval and transmission to remote locations. Optel provides a wide array of page management utilities that greatly facilitate the adaptation of course materials. Using these, material is stored on disks in the same way that overheads and other planned visual support materials are incorporated in the traditional classroom.⁻²

From this description and subsequent hands-on testing by Community Colleges of Spokane personnel, it is clear that the Optel system will provide the enhancements desired by instructors and students, and will also reduce or eliminate problems associated with delivery of visual aid materials to remote class locations.

Other advantages of a computer graphics system include those identified earlier in this paper as central to the northeast Washington solution: cost effectiveness, reliability, and flexibility. The Optel system is relatively inexpensive (particularly as compared with interactive television), has a short start-up time for acquisition and installation, requires little training to operate, and the equipment can be moved easily from one location to another and/or used for a variety of purposes. Because the equipment is dependable, easy to operate, and provides high quality

voice and data transmission, the potential exists for a wide spectrum of uses by many sectors of rural communities.

Partially because of this potential, but largely due to the positive impacts of increased higher education opportunities already evidenced in the area, local business and industry responded enthusiastically to requests for financial support for enhancement of the Colville Center's audio conference network. Several firms and foundations were approached by the Center in cooperation with the Community Colleges of Spokane Foundation, and grants ranging from \$1,000 to \$50,000, and totaling \$78,000, were received within a six-month period. These funds will serve to augment the limited operational funds provided through the College's state budget by providing equipment for enhancement of the existing network.

Summary

Several of the problems typically associated with efforts to extend higher education opportunities to rural communities, including small class size, lack of qualified instructors, and maintenance of quality standards, are successfully addressed by an audio conference network. Students in remote locations can participate in classes offered through regional centers where class size requirements are already met, and trained instructors are available.

The addition of computer graphics capabilities to such a network increases the potential for classroom interaction and reduces problems associated with delivery of visual aids and other learning materials to distance learning sites. The Voice-Too modem incorporated in the Optel Telewriter II-PC[™] system transmits voice and data simultaneously on one standard, dial up telephone line, thus preserving the cost effectiveness of the audio conference method, a key to realizing the goal of providing equal opportunity in education to rural America.

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